

PERRY LAKE
1999 Water Quality Report

1. General.

a. **Project location.** Perry Dam is located at river mile 5.3 on the Delaware River, 3 miles northwest of Perry, Kansas. The project watershed encompasses 1,117 square miles.

b. **Authorized project purposes.** Flood control and water supply are the primary project purposes; equally important, however, are its fish and wildlife resources and recreation benefits.

c. **Pertinent data.**

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1,000 A.F.)	Surface Area (Acres)	Shoreline (miles)
Flood Control	920.6	509.3	25,347	
Multipurpose	891.5	206.7*	11,146	160
Inactive		90.7**		
Total		716.0		

Total Drainage Area: 1,117 sq. miles

Average Annual Inflow: 585,391 acre-feet

* Estimate based on most recent hydrographic survey.

** Contained in multipurpose pool.

2. Activities and studies of the year.

Monthly herbicide and nutrient sampling was conducted by lake project personnel, with technical and analytical support from PM-PR-W, April-September 1999 at two inflow stations, three lake stations (two depths), and the outlet. Nutrient samples were shipped to the Chemical and Materials Quality Assurance Laboratory (CMQAL) in Omaha for analysis while the herbicide samples were shipped to the PM-PR-W laboratory for analysis of four of the most commonly occurring herbicides by the ELISA (enzyme linked immunosorbent assay) method. Ten percent of the herbicide samples were shipped to the CMQAL to be analyzed by Gas Chromatography (GC) for quality control purposes. All generated data were entered in excel spreadsheets as an interim to the EPA national water quality data management system, NEW STORET, which is still in the developmental stage. Table 1 at the end of this report includes all the available nutrient and herbicide data for the past years from 1996-1999.

The OF-PE is to be commended for its continued support of water quality monitoring of Perry Lake and its tributaries. The OF-PE personnel deserving special recognition include Mrs. Bunnie Watkins, Mr. Robert Reed, and Mr. Francis Funk.

3. Existing conditions.

a. **Inflow.** Six monthly samples were collected at both the Delaware River inflow station (PE-29) and the Rock Creek inflow station (PE-17) during April-September 1999. Total nitrogen (i.e., $\text{NH}_3 + \text{TKN} + \text{NO}_2 + \text{NO}_3$) mean concentrations ranged from eutrophic levels ($> 1 \text{ mg/L}$) of 3.42 mg/L in the Delaware River to 0.91 mg/L in Rock Creek. Total nitrogen

concentrations for the period of record have generally exceeded the EPA criterion for the protection of aquatic ecosystems from excessive eutrophication ($< 1 \text{ mg/L}$) and have demonstrated the elevated, long-term, nutrient loading to

FIGURE 1: PE-29

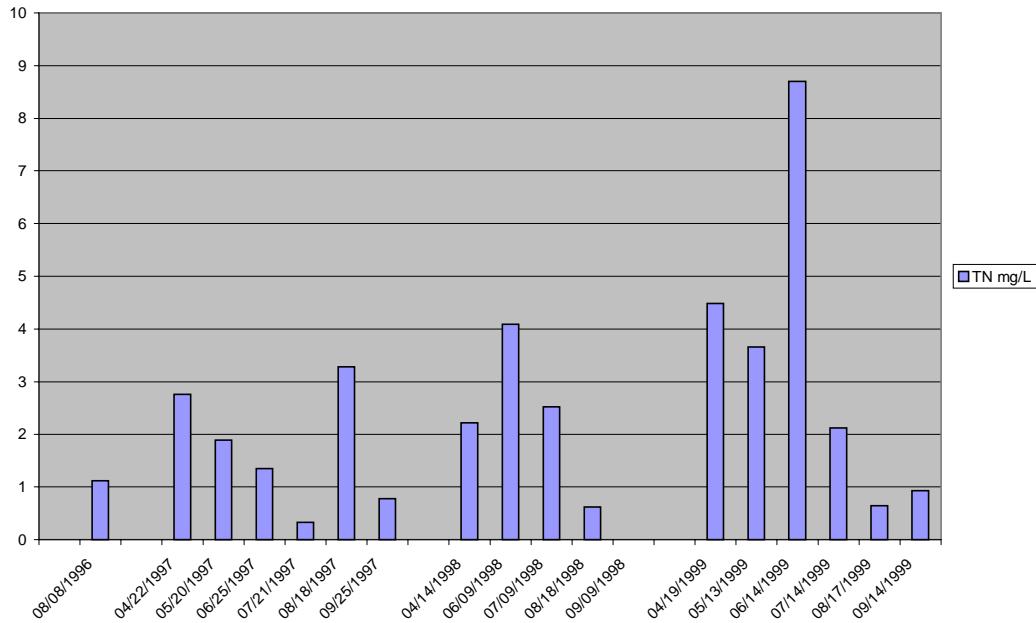
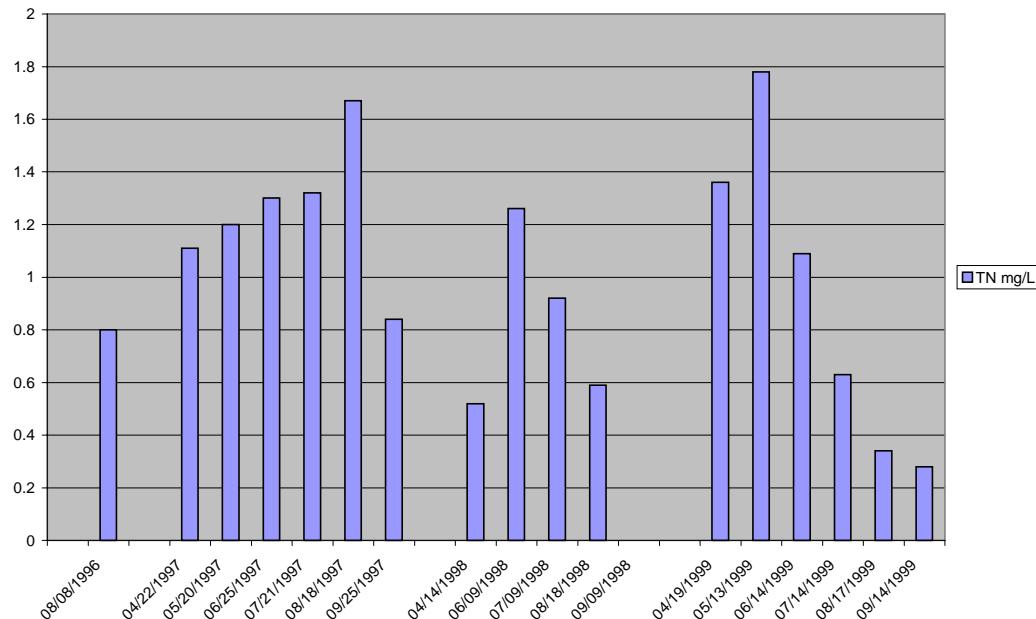


FIGURE 2: PE-17



both streams. Figures 1 and 2 show the trend for total nitrogen concentrations over the past three years. Spikes typically occur during high inflows such as April, May, and June of 1999. Total phosphorus mean concentrations followed the same pattern from eutrophic levels (> 0.1

mg/L) of 0.57 mg/L in the Delaware River to 0.08 mg/L in the

Rock Creek stream.

These, as well as other nutrient parameters, indicate substantial nutrient loading in both the inflows to Perry Lake. Figures 3 and 4 show this trend for the past three years.

FIGURE 3: PE-29

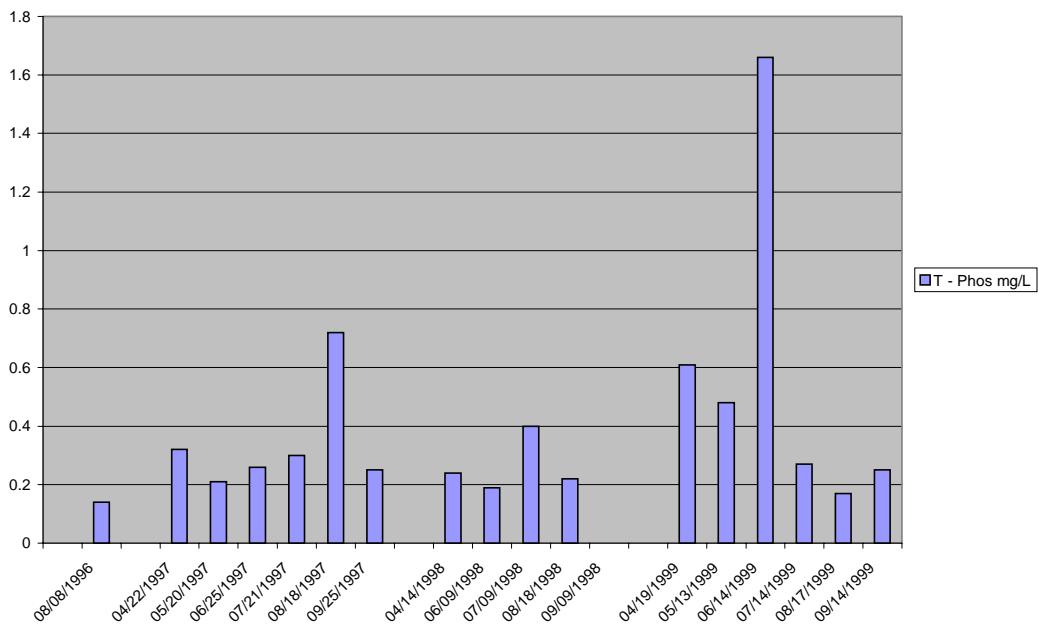
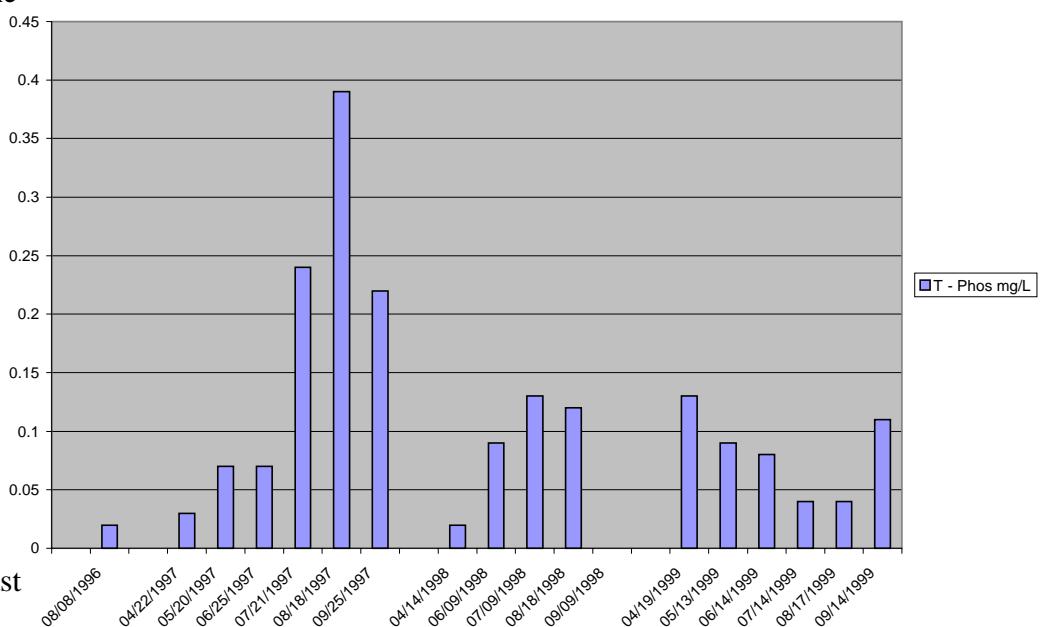


FIGURE 4: PE-17



The four pesticides (atrazine, metolachlor, alachlor, and cyanazine) were detected during the six monthly sampling periods at both inflows. Atrazine was detected in 100% of the PE-29 samples (mean and maximum concentrations of 7.97 ug/L and 38.50 ug/L, respectively) and in 83% of the PE-17 samples (mean and maximum concentrations of 0.46 ug/L and 1.84 ug/L,

respectively). Three samples from the Delaware River inflow exceeded the EPA criterion of 3 ug/L for drinking water supplies. The concentrations of atrazine were much lower during the later three months of the year which were representative of low flow periods. Figures 5 and 6 show this typical pattern of high concentrations during high flow, high application periods with lower concentrations during other months. Concentrations of alachlor averaged 1.09 ug/L and 0.87 ug/L, respectively.

June samples from both inflows exceeded the EPA criterion of 2 ug/L. Cyanazine concentrations were low and did not exceed established criteria. Two metolachlor samples from the Delaware River inflow exceeded 3 ug/L, but no criterion has been established for it.

FIGURE 5: PE-29

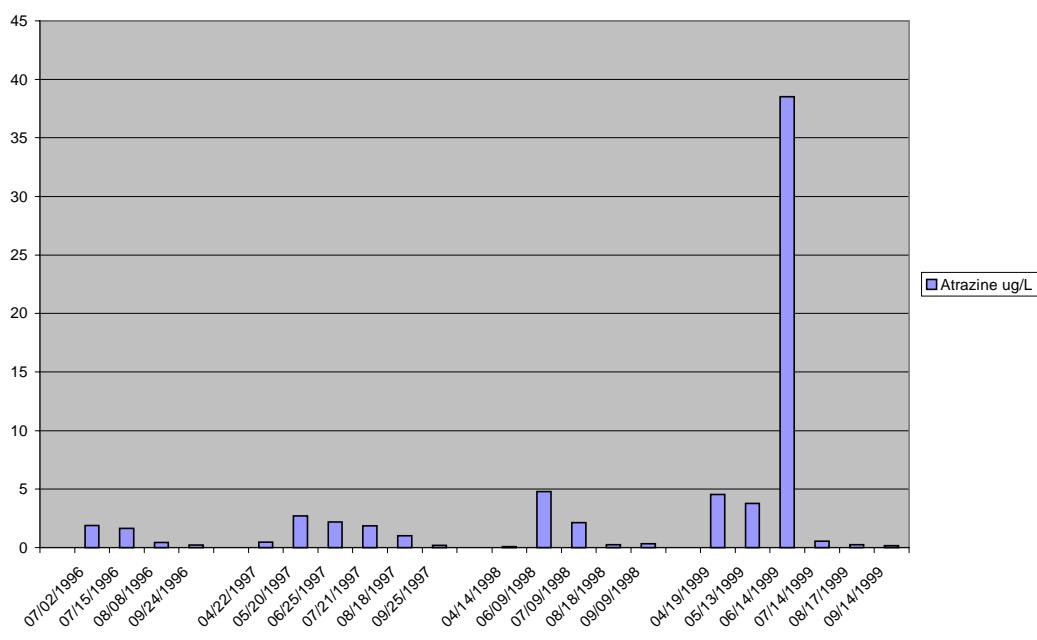
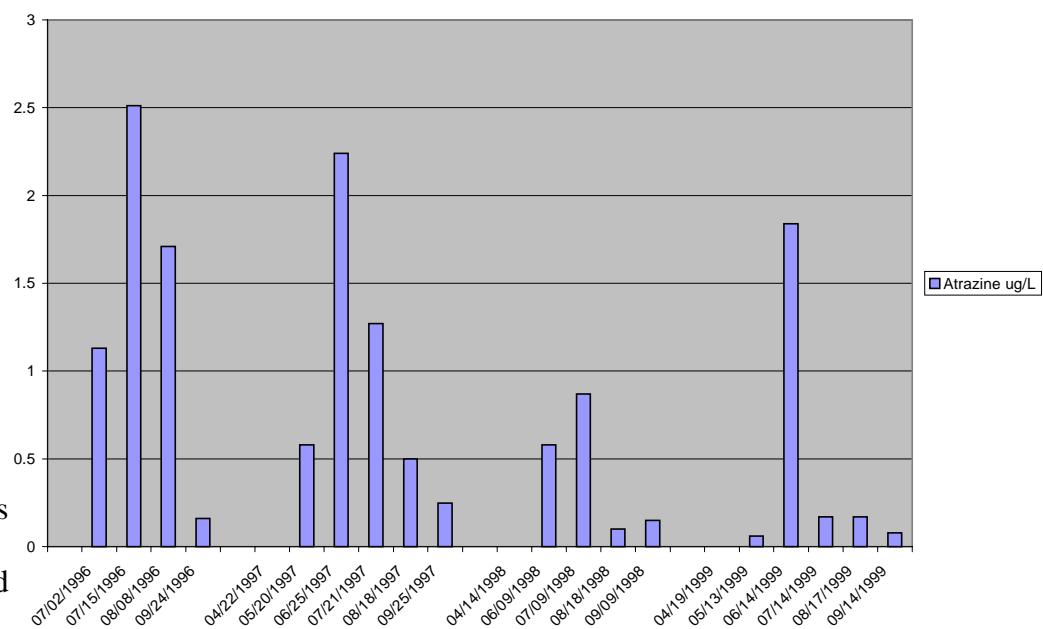


FIGURE 6: PE-17



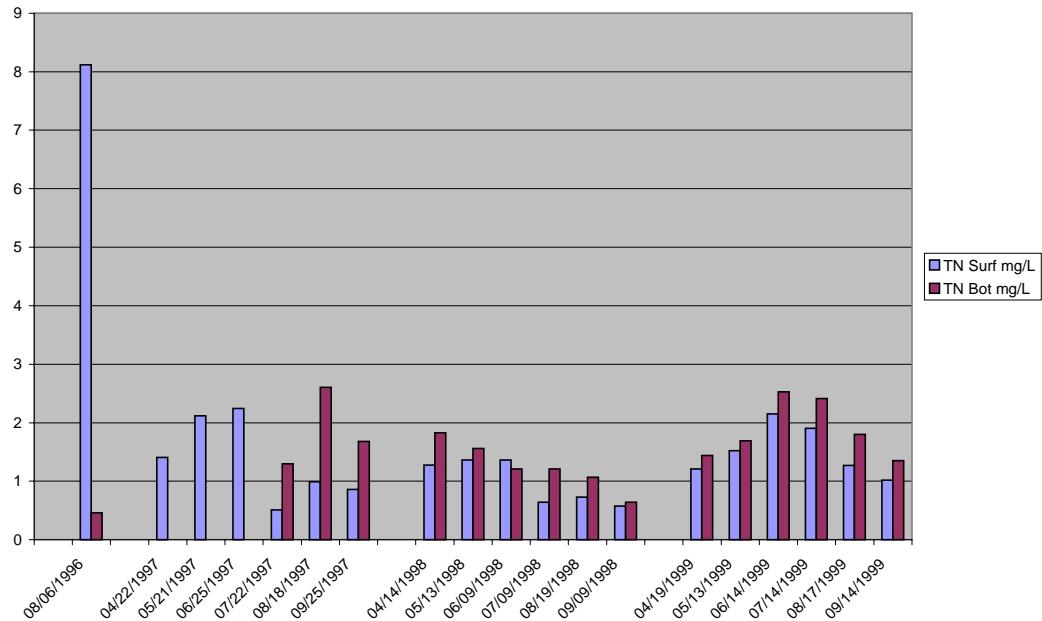
b. **Lake.** The downlake area near the dam (PE-2), uplake in the Delaware arm (PE-6) and uplake in the Rock Creek arm (PE-13) were sampled during the six months from April through September 1999. As can be seen in figures 7, 8, and 9, nutrient concentrations were typical of

the impoundment over the period of record.

These three graphs show the

relationship
between
surface and
bottom

FIGURE 7: PE-2

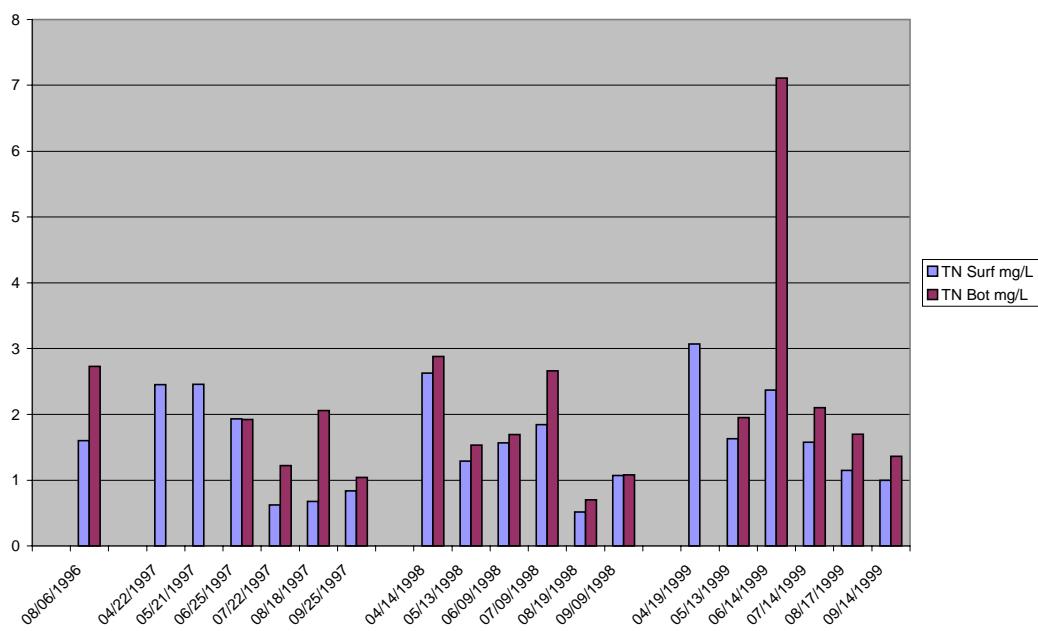


concentrations for the past three years. Concentrations within the water column and throughout the lake appear to be fairly uniform. The high

spikes can be attributed to high inflows and temperature difference between surface and bottom waters. Nutrient concentrations were at or above eutrophic levels at all three locations. The 1999 mean and

maximum concentrations in the surface waters were 1.51 mg/L and 2.15 mg/L, respectively, at PE-2, 1.80 mg/L and 3.07 mg/L, respectively, at PE-6, and 1.51 mg/L and 2.05 mg/L, respectively, at PE-13. These concentrations remained fairly constant throughout the lake. Values in the bottom waters were higher with mean and maximum concentrations of 1.87 mg/L

FIGURE 8: PE-6



and 2.53 mg/L, respectively, at PE-2, 2.84 mg/L and 7.11 mg/L, respectively, at PE-6, and 2.21 mg/L and 2.88 mg/L, respectively, at PE-13. Total phosphorus concentrations contributed to the eutrophic nature of the lake with mean and maximum concentrations in the surface waters of 0.13 mg/L and 0.15 mg/L,

FIGURE 9: PE-13

respectively, at PE-2, 0.17 mg/L and 0.23 mg/L, respectively, at PE-6, and 0.11 mg/L and 0.15 mg/L, respectively, at PE-13.

Mean TP concentrations were also higher in the bottom waters (0.13 mg/L, 0.55 mg/L, and 0.27

mg/L, respectively). Figures 10, 11, and 12 show total phosphorus concentrations at the surface and bottom depths throughout the lake from 1996-1999. Total phosphorus concentrations tend to follow the same pattern as the total nitrogen concentrations, fairly uniform throughout the lake. Thus, the lake continues to be moderately to highly enriched with nutrients.

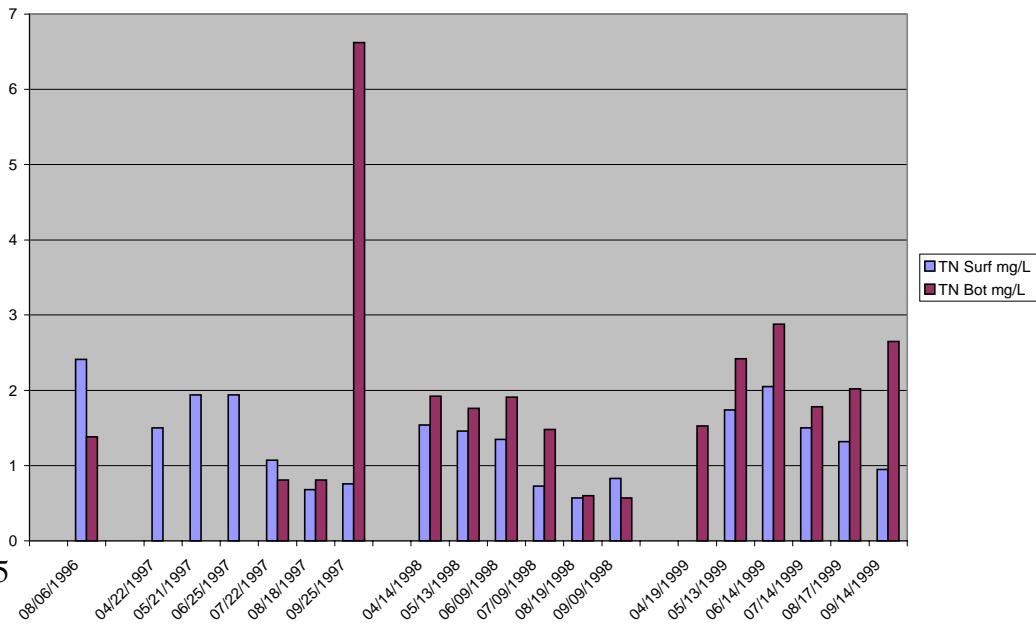


FIGURE 10: PE-2

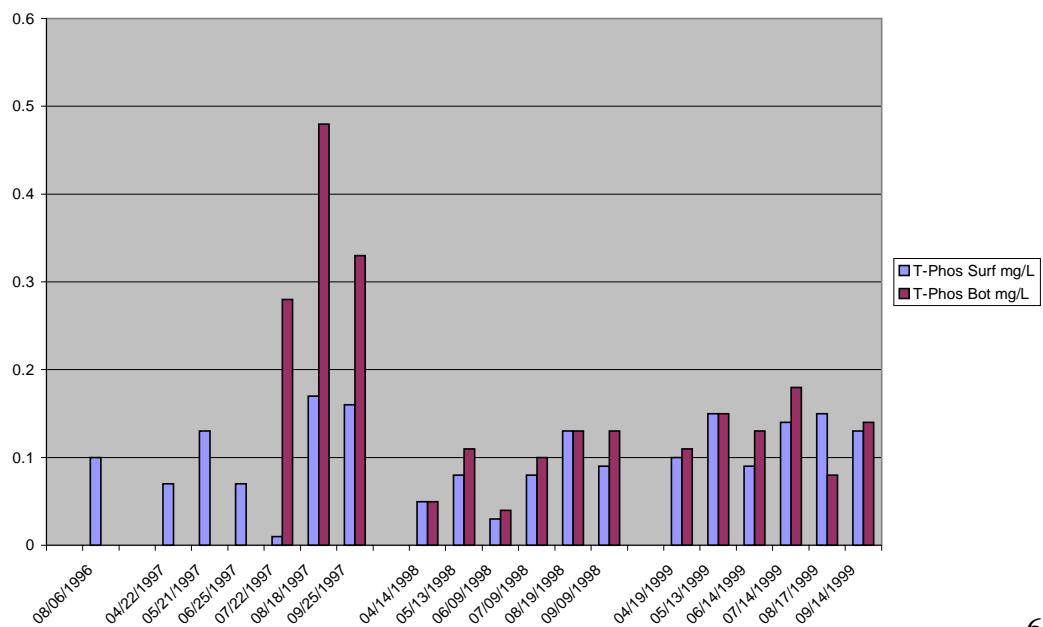


FIGURE 11: PE-6

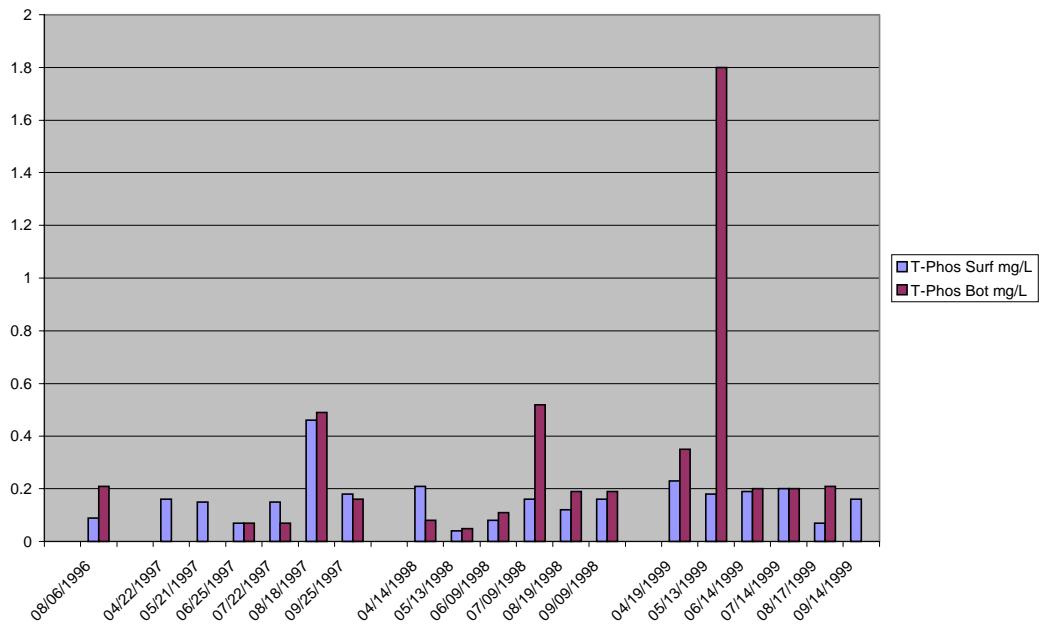
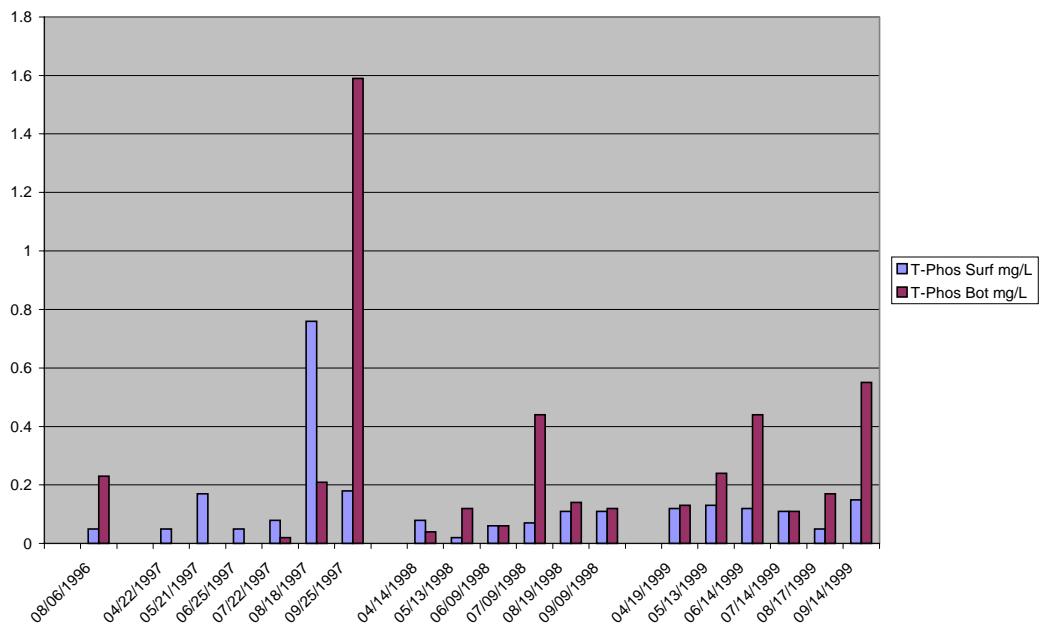


FIGURE 12: PE-13



In the monthly surveys for herbicides, the above three lake sites were sampled. All four of the herbicides tested (atrazine, metolachlor, alachlor, and cyanazine) were detected both in surface and bottom waters.

Atrazine was detected in 100% of the 1999 samples. Twenty percent of the samples exceeded the MCL of 3 ug/L set by EPA. The mean and

maximum atrazine concentrations in the surface waters of the lake were as follows, 1.41 ug/L and 3.53 ug/L (PE-2); 1.97 ug/L and 3.84 ug/L (PE-6); 1.48 ug/L and 2.56 ug/L (PE-13), respectively. Bottom mean and maximum atrazine concentrations for the above areas were 1.38 ug/L and 3.13 ug/L; 5.19 ug/L and 18.80

ug/L; 1.38 ug/L and 3.36 ug/L, respectively. Figures 13, 14, and 15 show the trend for atrazine for the years 1996-1999. As can be seen from these graphs high

FIGURE 13: PE-2

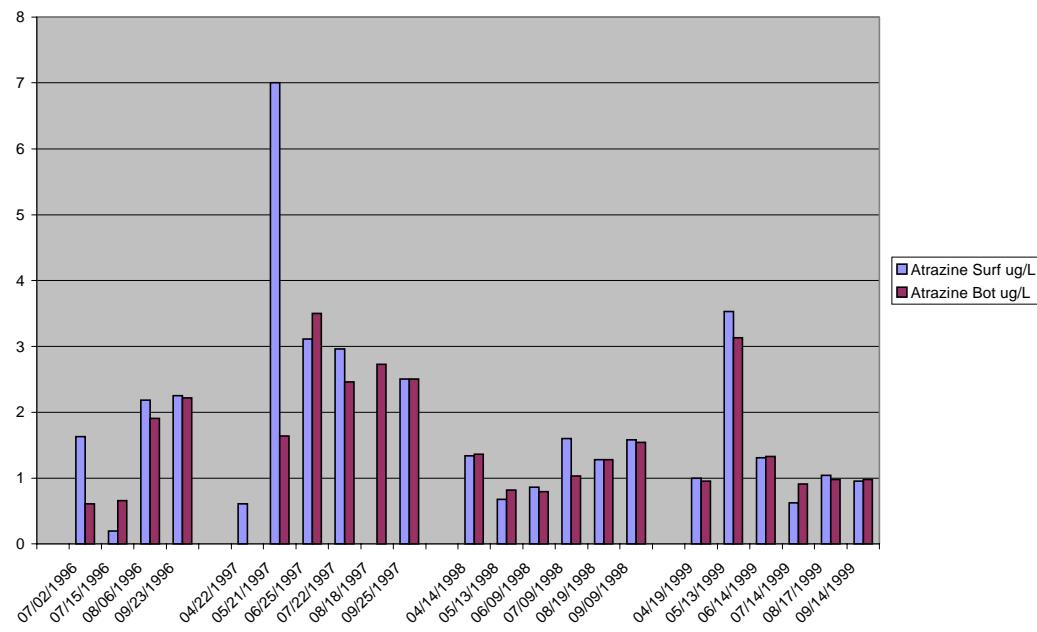
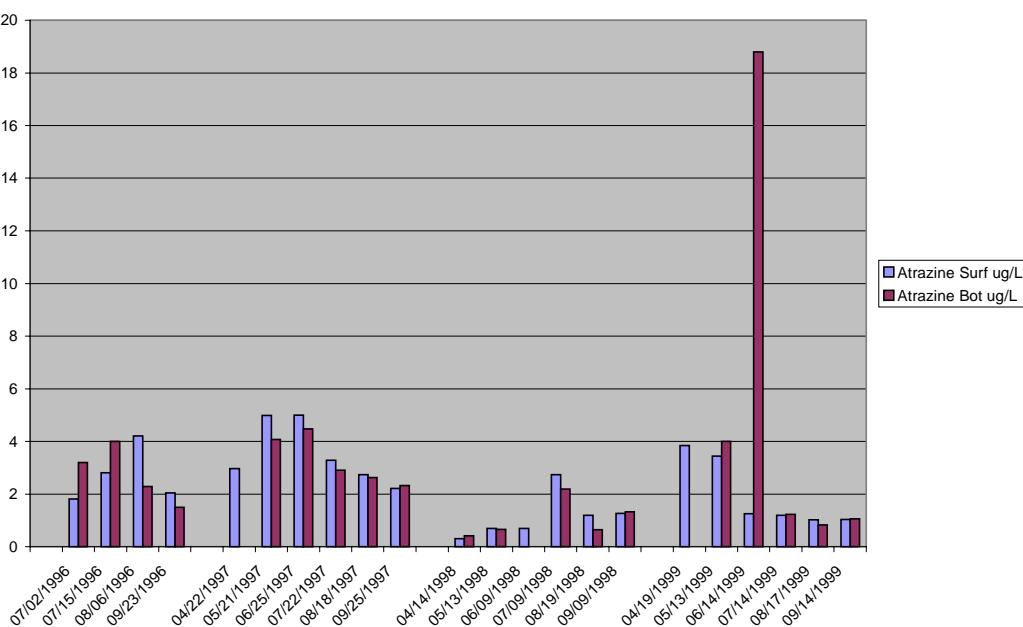


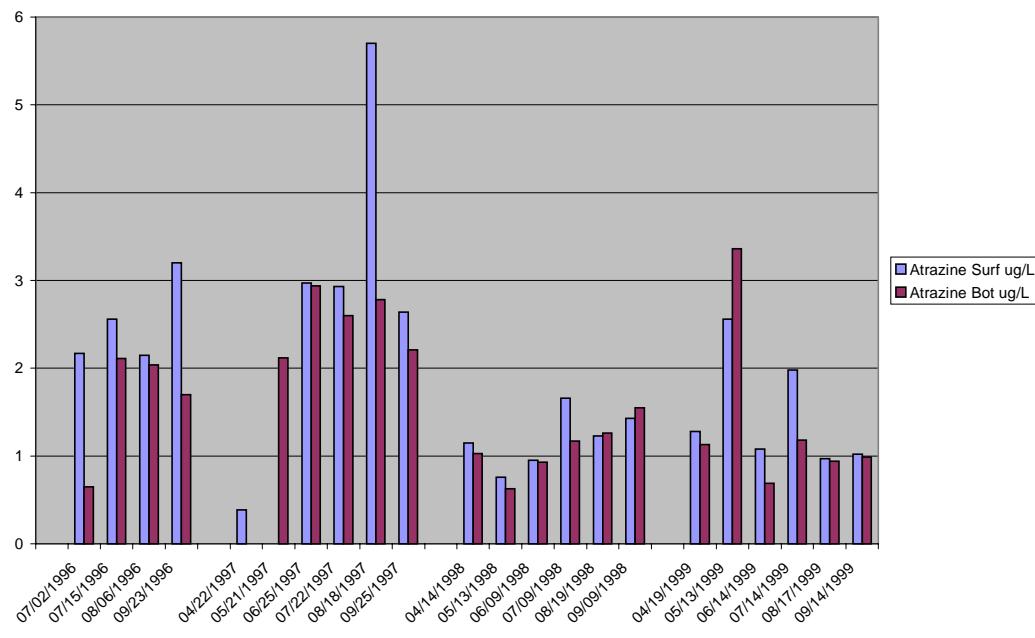
FIGURE 14: PE-6



concentrations occur throughout the lake in early spring during the high application, high run-off periods and level off. For the most part concentrations are uniform throughout the water column and the lake. Metolachlor was detected in 100% of the samples

also. The mean and maximum metolachlor concentrations in the surface waters were 1.99 ug/L and 3.07 ug/L (PE-2); 2.25 ug/L and 3.81 ug/L (PE-6); and 1.89 ug/L and 2.72 ug/L (PE-13), respectively. Bottom mean and maximum metolachlor concentrations for the above areas were 1.97 ug/L and 2.81 ug/L; 3.65 ug/L and 10.50 ug/L; and 1.94 ug/L and 2.68 ug/L, respectively. Although alachlor and cyanazine were detected, concentrations were low and only one sample exceeded the EPA criterion of 2 ug/L for alachlor. The cyanazine criterion was not exceeded.

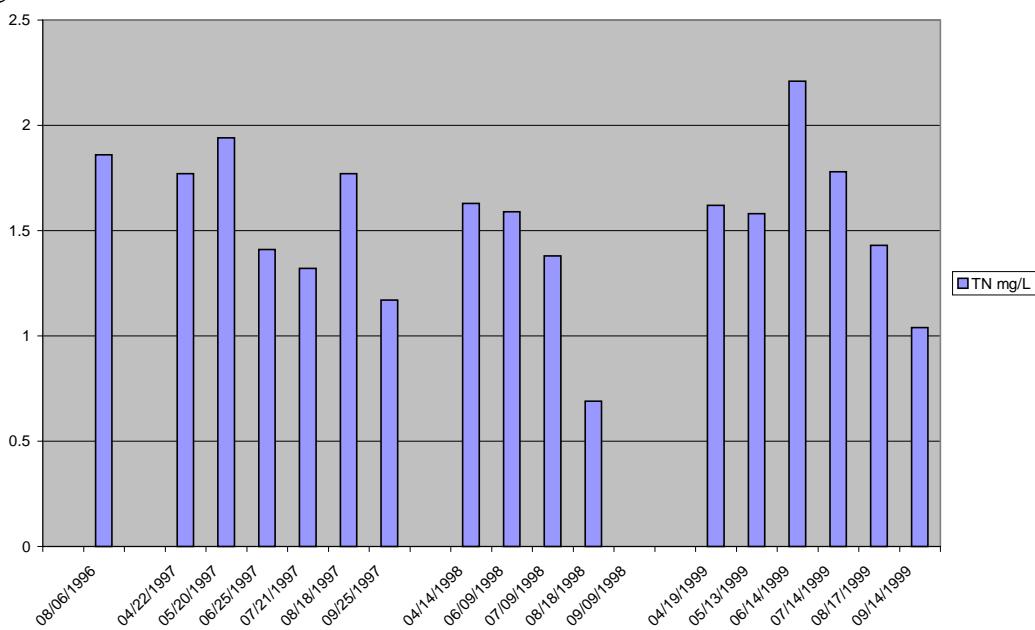
FIGURE 15: PE-13



c. **Outflow.** The water quality of the downstream reach (station PE-1) maintained most of the qualities of the bottom withdrawal waters. Mean 1999 concentrations of total nitrogen, 1.61 mg/L, and total phosphorus, 0.22 mg/L, were indicative of high nutrient

enrichment in the outlet waters of Perry Lake. Figures 16 and 17 show this trend from 1996-1999. Again, concentrations are higher during high flow periods. Herbicides detected in the outlet were

FIGURE 16: PE-1



atrazine, metolachlor, alachlor, and cyanazine.

The mean and maximum atrazine concentrations were 1.32 ug/L and 3.44 ug/L, respectively.

Only one sample exceeded the EPA criterion of 3 ug/L for drinking water. Figure 18 shows the trend for the years 1996-1999.

As can be seen from this graph, there was a decrease in atrazine concentrations in the outlet during most of the 1999 sampling period. The mean and maximum alachlor concentrations were 0.90 ug/L and 1.26 ug/L, respectively. The mean and maximum

metolachlor concentrations were 2.00 ug/L and 2.72 ug/L, respectively.

With the exception of the one sample exceeding the criterion for atrazine, none of the other samples exceeded established EPA criteria.

FIGURE 17: PE-1

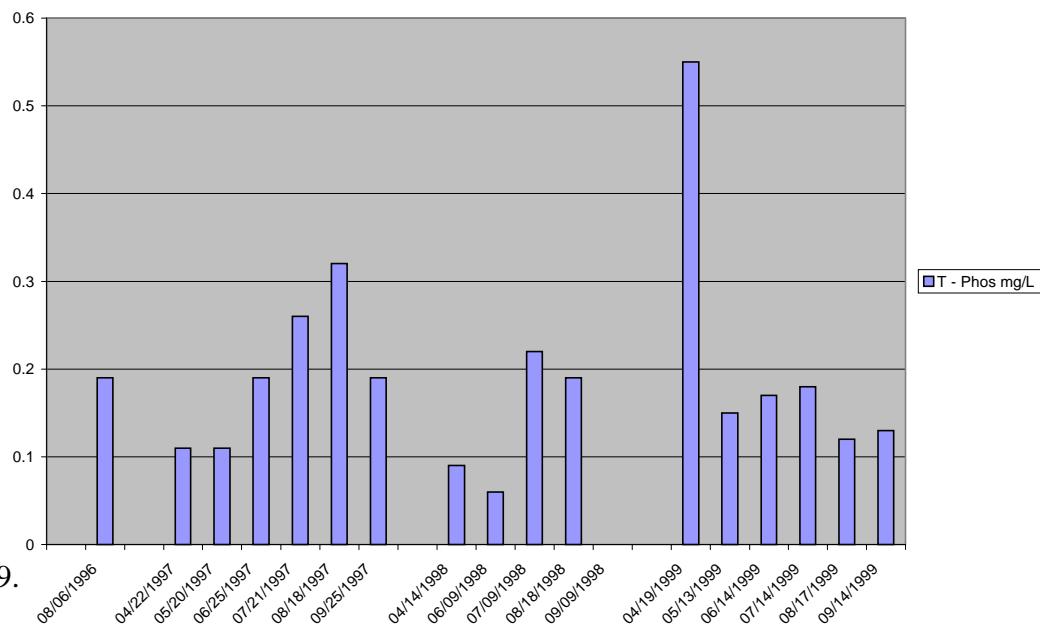
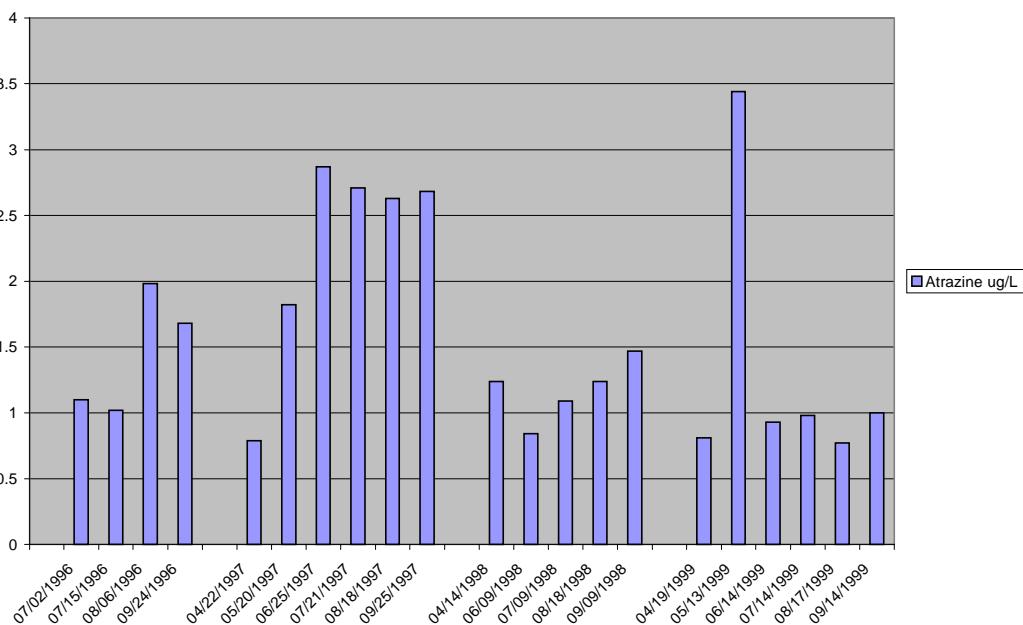


FIGURE 18: PE-1



4. Future conditions.

Although the overall water quality of Perry Lake is satisfactory as evidenced by the continued excellent crappie fishery, the excessive sedimentation, turbidity, suspended solids, nutrient loading, and pesticide levels associated with watershed run-off must be addressed. The pesticide levels pose a continuing threat to the drinking water supplies for the project. Additional water treatment removes pesticides and organic carbons, but cost effectiveness is not yet ascertainable. A special pesticide application district has been established to reduce watershed contributions.

5. Recommendations.

With the current staffing and funding levels, the water quality surveillance program for Perry Lake will continue to be limited in 2000. Routine, monthly pesticide sampling should continue to be conducted by Project personnel with logistic and analytical support from PM-PR-W. The District should enlist the other state and Federal agencies in developing a cooperative water quality monitoring and abatement program for Perry Lake and its watershed in 2001 similar to the one currently underway for Hillsdale Lake and the Big Bull watershed.

TABLE 1: PERRY LAKE DATA 1996-1999

Station	Depth M	Date mm/dd/yy	Time hh/mm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
PE - 29	0.1	07/02/1996	1130	1.88	0.44	0.77	0.08						
	0.1	07/15/1996	1435	1.65	0.41	0.11	0.05						
	0.1	08/08/1996	1315	0.46	0.05	0.41	0.09	0.08	0.54	0.5	1.12	0.14	0.13
	0.1	09/24/1996	0912	0.25	0.06	0.07	<0.04						
Average				1.06	0.24	0.34	0.07	0.08	0.54	0.50	1.12	0.14	0.13
PE - 29	0.1	04/22/1997	1050	0.48	0.07	0.42	0.11	0.1	1.66	1	2.76	0.32	0.32
	0.1	05/20/1997	1050	2.7	0.38	1.67	0.33	0.08	0.91	0.9	1.89	0.21	0.11
	0.1	06/25/1997	1515	2.21	0.96	0.75	0.24	0.02	0.33	1	1.35	0.26	0.11
	0.1	07/21/1997	1030	1.86	0.6	0.92	0.18	0.07	0.16	0.1	0.33	0.3	0.11
	0.1	08/18/1997	1505	1.01	0.65	1.07	0.07	<0.02	0.98	2.3	3.28	0.72	0.22
	0.1	09/25/1997	1430	0.19	0.1	0.05	0.04	0.1	0.08	0.6	0.78	0.25	0.07
Average				1.41	0.46	0.81	0.16	0.07	0.69	0.98	1.73	0.34	0.16
PE - 29	0.1	04/14/1998	1130	0.09	<0.05	0.07	<0.04	0.03	1.49	0.7	2.22	0.24	0.14
	0.1	06/09/1998	1140	4.81	1.09	3.53	0.3	0.2	2.69	1.2	4.09	0.19	0.12
	0.1	07/09/1998	1440	2.14	0.58	1.08	0.14	0.08	0.84	1.6	2.52	0.4	0.15
	0.1	08/18/1998	1000	0.27	<0.05	0.15	<0.04	0.17	0.15	0.3	0.62	0.22	0.11
	0.1	09/09/1998	1120	0.35	0.07	0.12	0.05	<0.02	<0.01	<0.1	0	<0.01	0.13
Average				1.53	0.58	0.99	0.16	0.12	1.29	0.95	1.89	0.26	0.13
PE - 29	0.1	04/19/1999	1225	4.53	0.71	3.45	0.21	U	2.88	1.6	4.48	0.61	0.13
	0.1	05/13/1999	1400	3.78	0.68	2.32	0.16	0.29	2.18	1.19	3.66	0.48	0.09
	0.1	06/14/1999	1200	38.5	4.9	14.9	0.36	0.14	3.61	4.95	8.7	1.66	0.1
	0.1	07/14/1999	0900	0.56	0.12	0.32	0.09	0.02	1.64	0.46	2.12	0.27	0.1
	0.1	08/17/1999	1225	0.27	0.06	0.15	<0.04	U	0.17	0.48	0.65	0.17	0.09
	0.1	09/14/1999	1100	0.15	0.05	0.1	<0.04	U	U	0.93	0.93	0.25	0.03
Average				7.97	1.09	3.54	0.21	0.15	2.10	1.60	3.42	0.57	0.09
PE - 17	0.1	07/02/1996	1300	1.13	0.23	<0.05	<0.04						
	0.1	07/15/1996	1500	2.51	1.29	<0.05	0.06						
	0.1	08/08/1996	1200	1.71	0.69	<0.05	0.16	<0.02	0.3	0.5	0.8	0.02	0.02
	0.1	09/24/1996	0830	0.16	<0.05	<0.05	<0.04						
Average				1.38	0.74		0.11		0.30	0.50	0.80	0.02	0.02
PE - 17	0.1	04/22/1997	1110	<0.05	0.13	<0.05	0.06	0.1	0.41	0.6	1.11	0.03	0.32
	0.1	05/20/1997	0930	0.58	0.3	<0.05	0.16	0.09	0.21	0.9	1.2	0.07	0.01
	0.1	06/25/1997	1425	2.24	1.35	<0.05	0.11	0.06	0.34	0.9	1.3	0.07	0.04
	0.1	07/21/1997	0940	1.27	0.96	<0.05	0.05	0.11	0.51	0.7	1.32	0.24	0.05
	0.1	08/18/1997	1420	0.5	0.81	<0.05	0.04	0.81	0.06	0.8	1.67	0.39	0.01
	0.1	09/25/1997	1340	0.25	0.29	<0.05	0.05	0.08	0.06	0.7	0.84	0.22	0.04
Average				0.97	0.64		0.08	0.21	0.27	0.77	1.24	0.17	0.08

Station	Depth M	Date mm/dd/yy	Time hh/mm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
PE - 17	0.1	04/14/1998	1045	<0.05	0.07	0.06	<0.04	0.02	0.1	0.4	0.52	0.02	0.02
	0.1	06/09/1998	1100	0.58	0.68	0.05	0.05	0.14	0.42	0.7	1.26	0.09	0.04
	0.1	07/09/1998	1525	0.87	0.8	<0.05	0.06	0.04	0.38	0.5	0.92	0.13	0.02
	0.1	08/18/1998	1100	0.1	0.18	<0.05	<0.04	<0.02	0.29	0.3	0.59	0.12	0.02
	0.1	09/09/1998	1245	0.15	0.14	<0.05	<0.04	<0.02	<0.01	<0.1	0	<0.01	0.04
	Average			0.43	0.37	0.06	0.06	0.07	0.30	0.48	0.66	0.09	0.03
PE - 17	0.1	04/19/1999	1100	<0.05	0.09	<0.05	<0.04	U	1.08	0.28	1.36	0.13	0.06
	0.1	05/13/1999	1453	0.06	0.7	<0.05	<0.04	0.1	1.26	0.42	1.78	0.09	0.03
	0.1	06/14/1999	1315	1.84	3.28	0.16	0.1	0.02	0.62	0.45	1.09	0.08	0.03
	0.1	07/14/1999	1000	0.17	0.69	<0.05	0.12	0.02	0.48	0.13	0.63	0.04	U
	0.1	08/17/1999	1100	0.17	0.29	0.06	<0.04	0.03	0.03	0.28	0.34	0.04	0.01
	0.1	09/14/1999	1220	0.08	0.19	<0.05	<0.04	U	U	0.28	0.28	0.11	0.01
	Average			0.46	0.87	0.11	0.11	0.04	0.69	0.31	0.91	0.08	0.03
PE - 1	0.1	07/02/1996	1250	1.1	1.75	1.62	0.1						
	0.1	07/15/1996	1530	1.02	1.44	0.5	0.05						
	0.1	08/06/1996	1530	1.98	1.24	1.77	0.18	0.04	0.32	1.5	1.86	0.19	0.11
	0.1	09/24/1996	0800	1.68	0.84	1.08	0.09						
	Average			1.45	1.32	1.24	0.11	0.04	0.32	1.50	1.86	0.19	0.11
PE - 1	0.1	04/22/1997	0845	0.79	0.43	0.55	0.16	0.02	0.75	1	1.77	0.11	0.11
	0.1	05/20/1997	0900	1.82	0.38	1.25	0.08	0.09	0.95	0.9	1.94	0.11	0.07
	0.1	06/25/1997	1145	2.87	1.06	1.43	0.2	0.16	0.15	1.1	1.41	0.19	0.09
	0.1	07/21/1997	1200	2.71	0.61	0.75	0.17	0.37	0.45	0.5	1.32	0.26	0.12
	0.1	08/18/1997	1150	2.63	0.5	1.17	0.14	0.1	0.17	1.5	1.77	0.32	0.14
	0.1	09/25/1997	1315	2.68	0.45	0.71	0.28	0.09	0.18	0.9	1.17	0.19	0.04
	Average			2.25	0.57	0.98	0.17	0.14	0.44	0.98	1.56	0.20	0.10
PE - 1	0.1	04/14/1998	1600	1.24	0.16	0.29	0.12	0.2	0.53	0.9	1.63	0.09	0.07
	0.1	06/09/1998	1500	0.84	0.15	0.25	0.07	0.25	0.64	0.7	1.59	0.06	0.05
	0.1	07/09/1998	1015	1.09	0.32	0.32	0.09	0.35	0.53	0.5	1.38	0.22	0.05
	0.1	08/18/1998	0900	1.24	0.83	0.63	0.07	<0.02	0.29	0.4	0.69	0.19	0.08
	0.1	09/09/1998	1430	1.47	0.48	0.79	0.12						
	Average			1.18	0.39	0.46	0.09	0.27	0.50	0.63	1.32	0.14	0.06
PE - 1	0.1	04/19/1999	1445	0.81	<0.05	0.39	0.08	U	0.63	0.99	1.62	0.55	0.04
	0.1	05/13/1999	1525	3.44	0.35	1.91	0.18	0.39	0.34	0.85	1.58	0.15	0.08
	0.1	06/14/1999	1440	0.93	0.71	2.49	0.06	U	1.59	0.62	2.21	0.17	0.07
	0.1	07/14/1999	1025	0.98	1.26	2.72	0.1	0.06	1.35	0.37	1.78	0.18	0.1
	0.1	08/17/1999	1325	0.77	1.2	2.34	0.05	U	0.07	1.36	1.43	0.12	0.03
	0.1	09/14/1999	1300	1	0.98	2.16	0.05	U	0.69	0.35	1.04	0.13	0.07
	Average			1.32	0.90	2.00	0.09	0.23	0.78	0.76	1.61	0.22	0.07

Station	Depth M	Date mm/dd/yy	Time hh/mm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
PE - 2	0.1	07/02/1996	1045	1.63	1.68	2.08	0.18						
	0.1	07/15/1996	1035	0.2	0.7	2	<0.1						
	0.1	08/06/1996	1300	2.18	1.14	1.88	0.19	<0.02	0.32	7.8	8.12	0.1	0.05
	0.1	09/23/1996	1500	2.25	2.06	1.39	0.08						
Average				1.57	1.40	1.84	0.15		0.32	7.80	8.12	0.10	0.05
PE - 2	0.1	04/22/1997	0830	0.61	0.26	0.42	0.14	<0.02	0.71	0.7	1.41	0.07	0.07
	0.1	05/21/1997	0900	7	<0.1	0.9	<0.1	0.15	0.97	1	2.12	0.13	0.07
	0.1	06/25/1997	1100	3.11	1.01	1.44	0.21	0.12	1.02	1.1	2.24	0.07	0.04
	0.1	07/22/1997	1005	2.96	0.57	1.45	0.19	<0.02	0.21	0.3	0.51	0.01	0.01
	0.1	08/18/1997	0915	<0.05	0.36	0.94	0.17	0.03	0.06	0.9	0.99	0.17	0.03
	0.1	09/25/1997	1115	2.5	0.37	0.6	0.25	0.05	0.21	0.6	0.86	0.16	0.03
Average				3.24	0.51	0.96	0.19	0.09	0.53	0.77	1.36	0.10	0.04
PE - 2	0.1	04/14/1998	1515	1.34	0.19	0.32	0.11	0.17	0.51	0.6	1.28	0.05	0.05
	0.1	05/13/1998	0935	0.68	0.2	0.16	0.08	0.13	0.73	0.5	1.36	0.08	0.01
	0.1	06/09/1998	0945	0.86	0.2	0.24	0.07	0.19	0.57	0.6	1.36	0.03	0.03
	0.1	07/09/1998	0940	1.6	0.48	0.52	0.12	0.12	0.22	0.3	0.64	0.08	0.02
	0.1	08/19/1998	1320	1.28	0.43	0.65	0.11	<0.02	0.03	0.7	0.73	0.13	0.02
	0.1	09/09/1998	1400	1.58	0.38	1.46	0.13	0.05	0.03	0.5	0.58	0.09	0.06
Average				1.22	0.31	0.56	0.10	0.13	0.35	0.53	0.99	0.08	0.03
PE - 2	0.1	04/19/1999	1050	1	0.14	0.51	0.08	U	0.69	0.52	1.21	0.1	0.07
	0.1	05/13/1999	1050	3.53	0.22	1.94	0.19	0.24	0.51	0.77	1.52	0.15	0.07
	0.1	06/14/1999	0900	1.31	0.71	2.17	0.08	0.04	1.6	0.51	2.15	0.09	0.08
	0.1	07/14/1999	1155	0.62	1.4	3.07	0.26	0.09	1.44	0.38	1.91	0.14	0.09
	0.1	08/17/1999	0900	1.04	1.14	2	0.06	U	0.9	0.37	1.27	0.15	0.06
	0.1	09/14/1999	0900	0.95	0.97	2.22	0.05	U	0.69	0.33	1.02	0.13	0.07
Average				1.41	0.76	1.99	0.12	0.12	0.97	0.48	1.51	0.13	0.07
PE - 2	20	07/02/1996	1105	0.61	1.99	2.14	<0.04						
	14.5	07/15/1996	1050	0.66	1.69	0.36	<0.04						
	16	08/06/1996	1316	1.91	1.26	1.46	0.16	0.16	0.3		0.46		0.15
	21	09/23/1996	1521	2.22	0.94	3.86	0.09						
Average				1.35	1.47	1.96	0.13	0.16	0.30		0.46		0.15
PE - 2	16	04/22/1997	0846										
	16	05/21/1997	0916	1.64	0.42	1.2	0.09						
	11	06/25/1997	1111	3.5	1.28	1.59	0.26						
	16	07/22/1997	1021	2.46	0.43	1.61	0.16	0.38	0.42	0.5	1.3	0.28	0.1
	16	08/18/1997	0931	2.73	0.65	1.1	0.21	0.81	0.1	1.7	2.61	0.48	0.15
	16	09/25/1997	1131	2.5	0.36	0.64	0.25	0.09	0.29	1.3	1.68	0.33	0.06
Average				2.57	0.63	1.23	0.19	0.43	0.27	1.17	1.86	0.36	0.10

Station	Depth M	Date mm/dd/yy	Time hh/mm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
PE - 2	8	04/14/1998	1523	1.36	0.22	0.35	0.13	0.19	0.54	1.1	1.83	0.05	0.04
	6	05/13/1998	0941	0.82	0.24	0.19	0.07	0.18	0.78	0.6	1.56	0.11	0.03
	11	06/09/1998	0956	0.79	0.19	0.24	0.08	0.2	0.61	0.4	1.21	0.04	0.03
	12	07/09/1998	0952	1.03	0.3	0.25	0.09	0.05	0.66	0.5	1.21	0.1	0.04
	6	08/19/1998	1326	1.28	0.33	0.51	0.11	0.03	0.34	0.7	1.07	0.13	0.05
	8	09/09/1998	1408	1.54	0.35	0.63	0.13	0.07	0.07	0.5	0.64	0.13	0.04
Average				1.14	0.27	0.36	0.10	0.12	0.50	0.63	1.25	0.09	0.04
PE - 2	11	04/19/1999	1101	0.95	0.13	0.49	0.07	U	0.7	0.74	1.44	0.11	0.07
	21	05/13/1999	1111	3.13	0.35	1.81	0.15	0.48	0.49	0.72	1.69	0.15	0.06
	15	06/14/1999	0915	1.33	0.82	2.33	0.09	0.05	1.62	0.86	2.53	0.13	0.09
	6	07/14/1999	1201	0.91	1.54	2.81	0.28	0.07	1.35	0.99	2.41	0.18	0.04
	12	08/17/1999	0912	0.98	1.14	2.03	0.05	0.04	0.96	0.8	1.8	0.08	0.07
	15	09/14/1999	0915	0.98	1	2.35	0.08	U	0.69	0.66	1.35	0.14	0.06
Average				1.38	0.83	1.97	0.12	0.16	0.97	0.80	1.87	0.13	0.07
PE - 6	0.1	07/02/1996	1140	1.81	1.41	2.39	0.25						
	0.1	07/15/1996	1135	2.81	1.96	0.3	0.13						
	0.1	08/06/1996	1100	4.2	0.6	0.3	<0.1	0.17	0.33	1.1	1.6	0.09	0.07
	0.1	09/23/1996	1330	2.05	0.91	3.48	0.07						
Average				2.72	1.22	1.62	0.15	0.17	0.33	1.10	1.60	0.09	0.07
PE - 6	0.1	04/22/1997	0950	2.97	0.61	2.19	0.27	0.02	1.03	1.4	2.45	0.16	0.1
	0.1	05/21/1997	1030	4.98	4.32	2.36	0.53	0.16	1.2	1.1	2.46	0.15	0.09
	0.1	06/25/1997	1000	4.99	1.62	2.06	0.39	0.23	0.5	1.2	1.93	0.07	0.03
	0.1	07/22/1997	0930	3.29	0.68	1.74	0.23	0.09	0.13	0.4	0.62	0.15	0.02
	0.1	08/18/1997	1000	2.75	0.65	1.1	0.21	0.02	0.06	0.6	0.68	0.46	0.05
	0.1	09/25/1997	1000	2.22	0.42	0.64	0.25	0.1	0.24	0.5	0.84	0.18	0.03
Average				3.53	1.38	1.68	0.31	0.10	0.53	0.87	1.50	0.20	0.05
PE - 6	0.1	04/14/1998	1345	0.31	0.13	2.09	<0.04	0.26	1.27	1.1	2.63	0.21	0.1
	0.1	05/13/1998	1045	0.7	0.16	0.29	0.1	0.09	0.6	0.6	1.29	0.04	0.01
	0.1	06/09/1998	0810	0.7	0.12	0.33	0.07	0.27	0.5	0.8	1.57	0.08	0.06
	0.1	07/09/1998	0815	2.75	1.23	1.59	0.18	0.27	0.57	1	1.84	0.16	0.07
	0.1	08/19/1998	1450	1.2	0.43	0.6	0.1	0.09	0.03	0.4	0.52	0.12	0.02
	0.1	09/09/1998	1025	1.27	0.33	0.51	0.1	0.05	0.12	0.9	1.07	0.16	0.1
Average				1.16	0.40	0.90	0.11	0.17	0.52	0.80	1.49	0.13	0.06
PE - 6	0.1	04/19/1999	1135	3.84	0.5	2.45	0.18	0.16	1.56	1.35	3.07	0.23	0.05
	0.1	05/13/1999	0950	3.44	0.38	1.7	0.16	0.1	0.74	0.79	1.63	0.18	0.11
	0.1	06/14/1999	1020	1.26	1.88	3.81	0.09	0.03	1.61	0.73	2.37	0.19	0.08
	0.1	07/14/1999	1345	1.2	1.3	2.43	0.31	0.03	0.97	0.58	1.58	0.2	0.09
	0.1	08/17/1999	0925	1.02	1.1	1.05	0.09	0.02	0.73	0.4	1.15	0.07	0.06
	0.1	09/14/1999	1000	1.04	0.8	2.03	0.07	U	0.47	0.53	1	0.16	0.07
Average				1.97	0.99	2.25	0.15	0.07	1.01	0.73	1.80	0.17	0.08

Station	Depth M	Date mm/dd/yy	Time hh/mm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
PE - 6	11	07/02/1996	1151	3.2	1.88	2.09	0.2						
	6.5	07/15/1996	1142	4.01	1.55	0.28	0.19						
	7	08/06/1996	1107	2.29	1.03	1.34	0.15	0.28	0.45	2	2.73	0.21	0.13
	10	09/23/1996	1340	1.49	0.76	0.79	0.07						
Average				2.75	1.31	1.13	0.15	0.28	0.45	2.00	2.73	0.21	0.13
PE - 6	5	04/22/1997	0955										
	5	05/21/1997	1035	4.08	1.02	2.46	0.47						
	6	06/25/1997	1006	4.48	1.56	2.1	0.41	0.23	0.49	1.2	1.92	0.07	0.04
	5	07/22/1997	0935	2.91	0.55	2.11	0.2	0.31	0.11	0.8	1.22	0.07	0.05
	7	08/18/1997	1007	2.63	0.66	1.15	0.26	0.1	0.06	1.9	2.06	0.49	0.06
	6	09/25/1997	1006	2.32	0.37	0.58	0.22	0.17	0.07	0.8	1.04	0.16	0.03
	Average			3.28	0.83	1.68	0.31	0.20	0.18	1.18	1.56	0.20	0.05
PE - 6	7	04/14/1998	1352	0.41	0.16	<0.05	0.06	0.28	1.2	1.4	2.88	0.08	0.07
	8	05/13/1998	1053	0.66	0.23	0.24	0.1	0.2	0.63	0.7	1.53	0.05	0.03
	5	06/09/1998	0815					0.22	0.47	1	1.69	0.11	0.06
	7	07/09/1998	0822	2.19	0.82	1.06	0.14	0.62	0.34	1.7	2.66	0.52	0.11
	6	08/19/1998	1456	0.65	0.44	0.51	0.08	<0.02	0.1	0.6	0.7	0.19	0.08
	6	09/09/1998	1031	1.33	0.35	0.48	0.1	0.17	0.11	0.8	1.08	0.19	0.13
	Average			1.05	0.40	0.57	0.10	0.30	0.48	1.03	1.76	0.19	0.08
PE-6	12	04/19/1999	1147										
	12	05/13/1999	1002	4.01	0.4	1.77	0.17	0.14	0.86	0.95	1.95	0.35	0.08
	9	06/14/1999	1029	18.8	3.57	10.5	0.64	0.19	2.07	4.85	7.11	1.8	0.06
	11	07/14/1999	1356	1.24	1.22	2.51	0.29	0.11	1.03	0.96	2.1	0.2	0.07
	6	08/17/1999	0931	0.84	0.86	1.4	0.06	0.04	0.47	1.19	1.7	0.2	0.07
	6	09/14/1999	1006	1.06	0.98	2.09	0.06	U	0.5	0.86	1.36	0.21	0.07
	Average			5.19	1.41	3.65	0.24	0.12	0.99	1.76	2.84	0.55	0.07
PE - 13	0.1	07/02/1996	1100	2.17	1.44	2.27	0.21						
	0.1	07/15/1996	1235	2.56	1.22	0.1	0.2						
	0.1	08/06/1996	1415	2.15	1.28	1.72	0.24	0.06	0.15	2.2	2.41	0.05	0.02
	0.1	09/23/1996	1405	3.2	0.3	1.5	<0.1						
	Average			2.52	1.06	1.40	0.22	0.06	0.15	2.20	2.41	0.05	0.02
PE - 13	0.1	04/22/1997	0910	0.39	<0.1	<0.1	<0.1	0.1	0.7	0.7	1.5	0.05	0.02
	0.1	05/21/1997	1000					0.12	1.02	0.8	1.94	0.17	0.07
	0.1	06/25/1997	0915	2.97	1.15	1.42	<0.1	0.13	0.71	1.1	1.94	0.05	0.03
	0.1	07/22/1997	0900	2.93	0.57	0.85	0.18	0.04	0.03	1	1.07	0.08	0.01
	0.1	08/18/1997	0855	5.7	0.1	1.02	<0.1	0.02	0.06	0.6	0.68	0.76	0.02
	0.1	09/25/1997	1100	2.64	0.5	0.75	0.28	0.13	0.13	0.5	0.76	0.18	0.03
	Average			2.93	0.58	1.01	0.23	0.09	0.44	0.78	1.32	0.22	0.03

Station	Depth M	Date mm/dd/yy	Time hh/mm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
PE - 13	0.1	04/14/1998	1420	1.15	0.15	0.28	0.1	0.12	0.52	0.9	1.54	0.08	0.06
	0.1	05/13/1998	0840	0.76	0.26	0.18	0.07	0.13	0.53	0.8	1.46	0.02	0.01
	0.1	06/09/1998	0900	0.95	0.28	0.22	0.08	0.26	0.49	0.6	1.35	0.06	0.04
	0.1	07/09/1998	0850	1.66	0.6	0.58	0.14	0.09	0.14	0.5	0.73	0.07	0.03
	0.1	08/19/1998	1410	1.23	0.33	0.55	0.12	0.04	0.03	0.5	0.57	0.11	0.02
	0.1	09/09/1998	1320	1.43	0.3	0.55	0.1	0.05	0.08	0.7	0.83	0.11	0.07
Average				1.20	0.32	0.39	0.10	0.12	0.30	0.67	1.08	0.08	0.04
PE - 13	0.1	04/19/1999	1015	1.28	0.14	0.56	0.08	U	0.79	0.44		0.12	0.04
	0.1	05/13/1999	0900	2.56	0.28	1.38	0.15	0.26	0.76	0.72	1.74	0.13	0.09
	0.1	06/14/1999	0930	1.08	0.95	2.37	0.07	U	1.5	0.55	2.05	0.12	0.07
	0.1	07/14/1999	1215	1.98	1.96	2.72	0.36	0.08	1.06	0.36	1.5	0.11	0.05
	0.1	08/17/1999	1000	0.97	1.12	2.06	0.06	U	0.78	0.54	1.32	0.05	0.04
	0.1	09/14/1999	0840	1.02	0.95	2.22	0.06	U	0.58	0.37	0.95	0.15	0.07
Average				1.48	0.90	1.89	0.13	0.17	0.91	0.50	1.51	0.11	0.06
PE - 13	16	07/02/1996	1116	0.65	1.78	2.12	<0.04						
	5.5	07/15/1996	1240	2.11	1.27	0.54	0.16						
	9	08/06/1996	1424	2.04	1.14	1.73	0.2	0.31	0.17	0.9	1.38	0.23	0.07
	8	09/23/1996	1413	1.7	0.64	1.12	0.07						
Average				1.63	1.21	1.38	0.14	0.31	0.17	0.90	1.38	0.23	0.07
PE - 13	6	04/22/1997	0916										
	6	05/21/1997	1006	2.12	0.58	1.2	0.14						
	10	06/25/1997	0925	2.94	<0.05	1.27	0.17						
	5	07/22/1997	0905	2.6	0.46	1.49	0.18	0.07	0.34	0.4	0.81	0.02	0.01
	10	08/18/1997	0905	2.78	0.68	1.06	0.23	0.02	0.09	0.7	0.81	0.21	0.04
	10	09/25/1997	1110	2.21	0.39	0.64	0.25	0.47	0.25	5.9	6.62	1.59	0.1
Average				2.53	0.53	1.13	0.19	0.19	0.23	2.33	2.75	0.61	0.05
PE - 13	11	04/14/1998	1431	1.03	0.15	0.23	0.11	0.17	0.55	1.2	1.92	0.04	0.04
	6	05/13/1998	0846	0.63	0.19	0.2	0.06	0.17	0.69	0.9	1.76	0.12	0.02
	7	06/09/1998	0907	0.93	0.29	0.28	0.1	0.28	0.53	1.1	1.91	0.06	0.04
	8	07/09/1998	0858	1.17	0.41	0.4	0.1	0.3	0.28	0.9	1.48	0.44	0.03
	6	08/19/1998	1416	1.26	0.39	0.63	0.12	0.08	0.12	0.4	0.6	0.14	0.03
	6	09/09/1998	1326	1.55	0.35	<0.05	0.12	0.07	0.1	0.4	0.57	0.12	0.05
Average				1.10	0.30	0.35	0.10	0.18	0.38	0.82	1.37	0.15	0.04
PE - 13	5	04/19/1999	1020	1.13	0.13	0.55	0.08	U	0.8	0.73	1.53	0.13	0.03
	18	05/13/1999	0918	3.36	0.37	1.88	0.18	0.41	1.1	0.91	2.42	0.24	0.05
	11	06/14/1999	0941	0.69	0.78	2.29	<0.04	0.12	1.2	1.56	2.88	0.44	0.05
	3	07/14/1999	1218	1.18	1.72	2.68	0.28	0.08	1.1	0.6	1.78	0.11	0.04
	11	08/17/1999	1011	0.94	1.14	2.1	0.06	0.04	0.92	1.06	2.02	0.17	0.05
	11	09/14/1999	0851	0.99	1.03	2.14	0.08	0.02	0.49	2.14	2.65	0.55	0.12
Average				1.38	0.86	1.94	0.14	0.13	0.94	1.17	2.21	0.27	0.06